Alteration of Terrain Rules Workshop
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Introduction

- Bathrooms
- Food
- Questions – comment sheet ★
- Workshop Agenda ★

★ = Handouts

Rule Adoption Schedule

Final proposal:

http://des.nh.gov/organization/commissioner/legal/rulemaking/

Timeline:

- November 2008 – 3 Vol Stormwater Manual
  - Stormwater and Antidegradation
  - Post-Construction BMPs: Selection & Design
  - Construction Erosion & Sediment Controls

- November 20, 2008 – JLCAR review anticipated

- January 1, 2009 – *Earliest* adoption date

Outline

- A look at the new application form
- Sample calculations
- BMP Toolbox and Terminology
- Infiltration rate selection
- Floodplain discussion
- Q & A

New Application ★

- UIC form ★

- Color coding HISS/SSSS mapping
  - Large enough to read soil groups within a subcathment

- Submittal order

- Checklist

Sample calculations ★

WQV

WQF

GRV

But first, some basic math skills...

You may see.... **WQV = (P)(Rv)(A) /12**

This equation only works with the correct units!

P must be in inches and A in square feet, to get ft³ as a result.

**The DES equation for WQV is NOT dependent
on a conversion factor.**

Unit Independent: WQV = (P)(Rv)(A)

For example, if you enter P = 1" and A in acres,
the result of your WQV is in **acre-inches**.

DES equation: Rv = 0.05 + 0.9(I) ... note I is in *decimal* form

You may also see: Rv = 0.05 + 0.009(I) .... note I is in *percent*

WQV = P x Rv x A

P = 1"
Rv = 0.05 + 0.9I
I = %imp cover, in decimal form
A = area draining to the structure

Example:
Given:
A = 0.80 ac draining to the structure, 0.60 ac of this area is impervious

Solution:
$I = \dfrac{0.60 \text{ ac}}{0.80 \text{ ac}} = 0.75$

Rv = 0.05 + 0.9I = 0.05 + 0.9(0.75) = 0.725

WQV = 1" x 0.725 x 0.80ac = 0.58 ac-in

WQF = qu × WQV

qu = unit peak discharge from TR-55 Exhibits 4-II or 4-III
qu = f (Tc, Ia/P)

P = 1"
Ia = initial abstraction = 0.2S

S = potential maximum retention = $\dfrac{1000}{CN}$ - 10

CN = $\dfrac{1000}{10+5P+10Q-10[Q^2 + 1.25(Q)(P)]^{0.5}}$

Q = the water quality depth in inches = WQV/A
A = Area draining to the structure

NOTE that this CN is not the same as the subcatchment's CN. Rather it is a representative CN used to convert the water quality depth to a flow rate.

WQF example:

Location of project: Concord, NH
A = 1 acre draining to the structure, 60% impervious cover
Tc = 12 min (0.2 hrs)

Solution:
WQV $= P \times Rv \times A$
Rv $= 0.05 + 0.9(I) = 0.05 + 0.9(0.60) = 0.59$
WQV $= 1" \times 0.59 \times 1ac = 0.59$ ac-in

$Q = WQV/A = 0.59$ ac-in $/ 1$ ac $= 0.59$ in
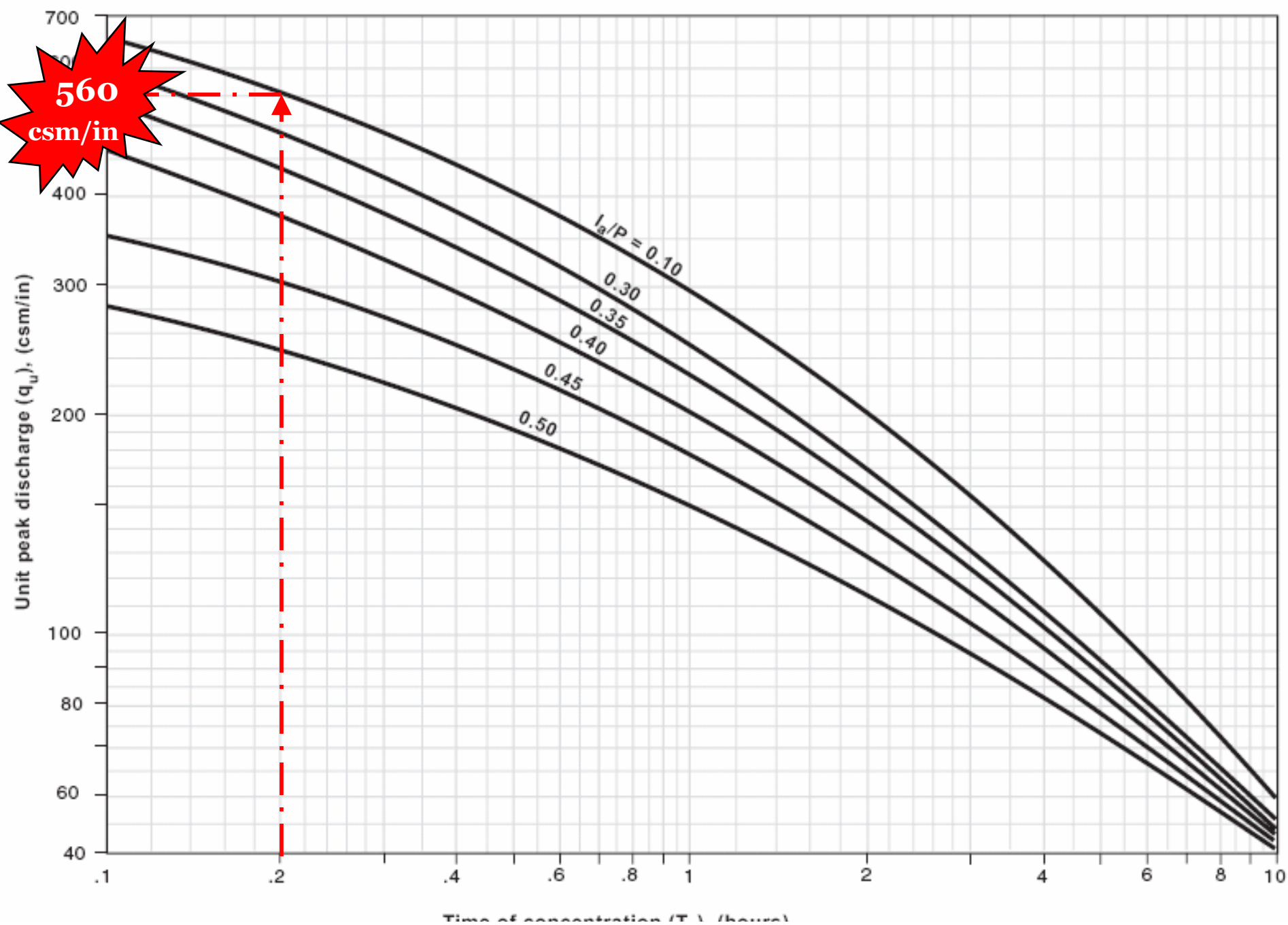
$$CN = \frac{1000}{10+5P+10Q-10[Q^2 + 1.25(Q)(P)]^{0.5}} = 95.4$$

$S = (1000/CN) - 10 = 1000/95.4 - 10 = 0.48$ in

$Ia = 0.2S = 0.2(0.48) = 0.10$ in

$Ia/P = 0.10$ in $/ 1$ in $= \mathbf{0.10}$
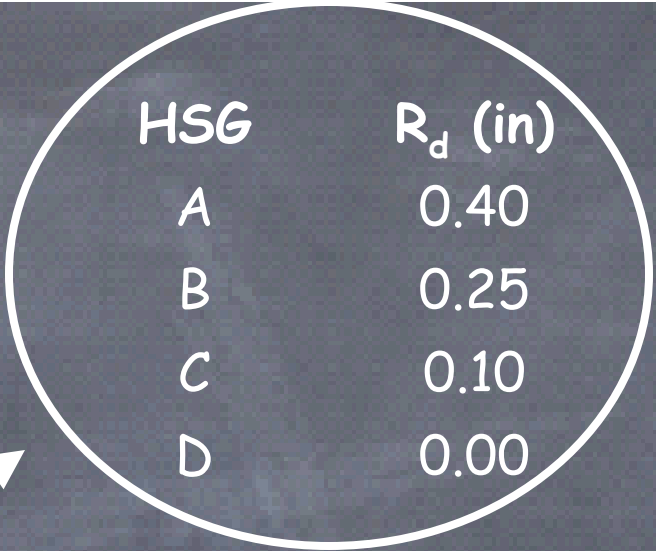
Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution

560 csm/in

$I_a/P = 0.10$
0.30
0.35
0.40
0.45
0.50

Unit peak discharge (q_u), (csm/in)

Time of concentration (T_) (hours)

GRV = A_I × Rd

A_I = impervious surfaces that will exist on the site after development

Rd = the groundwater recharge depth

HSG	R_d (in)
A	0.40
B	0.25
C	0.10
D	0.00

Example:
Given:
A = 10 acres
A_I = 1.5 ac (This area covers 1 ac HSG A soil & 0.5 ac C soil)

Solution:
GRV = A_I × Rd
Weighted Rd = [(1 ac)(0.40") + (0.5 ac)(0.10")]/1.5 ac = 0.30"
GRV   = 1.5 ac × 0.30" = <u>0.45 ac-in</u>

WQF example continued:

Note csm = cfs/mi^2

qu = 560 cfs/mi^2/in

WQF = qu x WQV
= 560 cfs/mi^2/in x 0.59 ac-in x (1 mi^2/640 ac)
= 0.52 cfs

Stormwater Treatment Tool Box & Terminology

1. Stormwater ponds

2. Stormwater wetlands

3. Infiltration practices

4. Filtering practices

5. Flow through swales

6. Vegetated Buffers

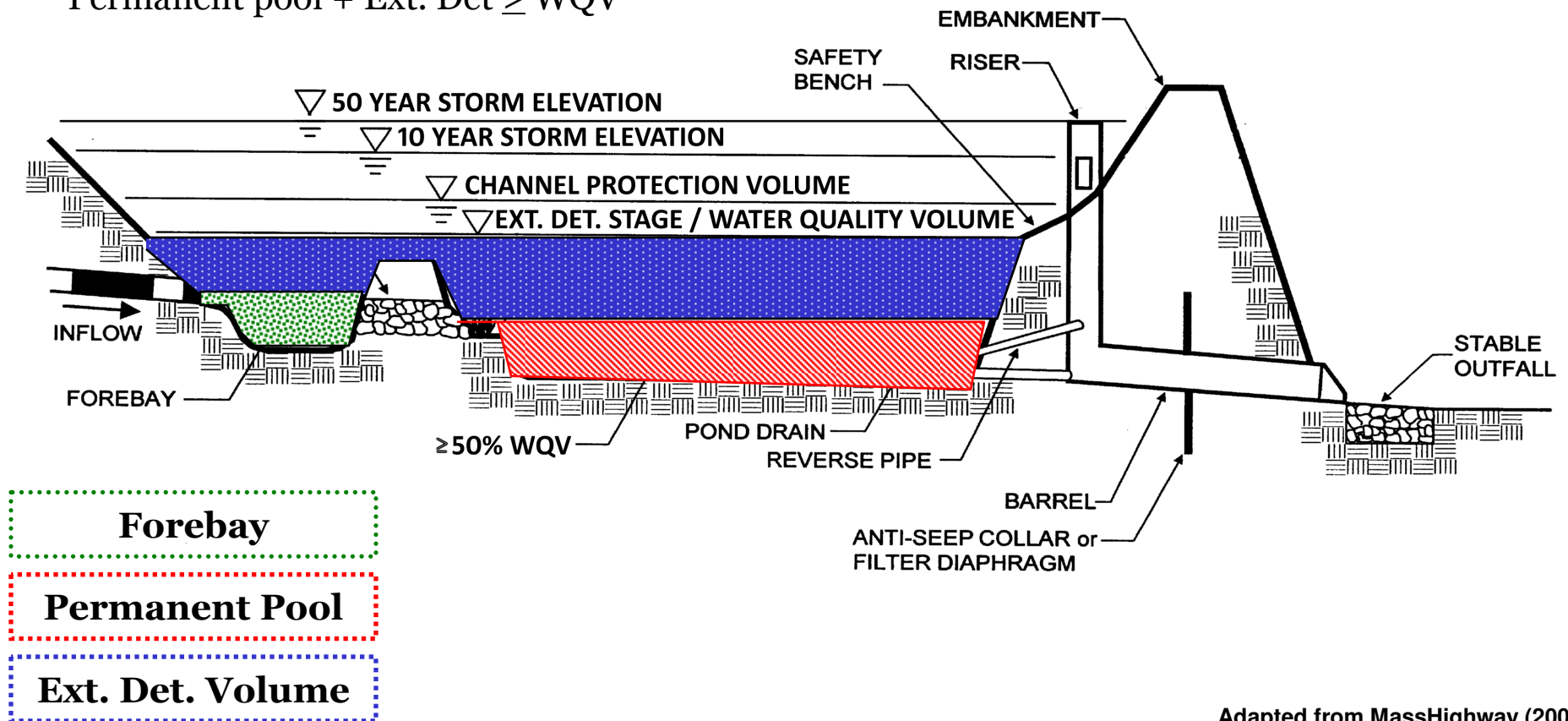See BMP design worksheets for sizing ★

Stormwater ponds

Example: Wet Extended Detention Pond

Criteria:
Forebay $\geq$ 10% WQV
Permanent Pool $\geq$ 50% WQV
Permanent pool + Ext. Det $\geq$ WQV

EMBANKMENT

SAFETY BENCH   RISER

▽ 50 YEAR STORM ELEVATION
▽ 10 YEAR STORM ELEVATION
▽ CHANNEL PROTECTION VOLUME
▽ EXT. DET. STAGE / WATER QUALITY VOLUME

INFLOW

FOREBAY

$\geq$50% WQV   POND DRAIN
REVERSE PIPE

BARREL

ANTI-SEEP COLLAR or FILTER DIAPHRAGM

STABLE OUTFALL

Forebay

Permanent Pool

Ext. Det. Volume

Adapted from MassHighway (2004)

If extended detention is used, how do I show this volume is detained for at least 24 hours?

$Q_{max} \leq 2 \, Q_{avg}$

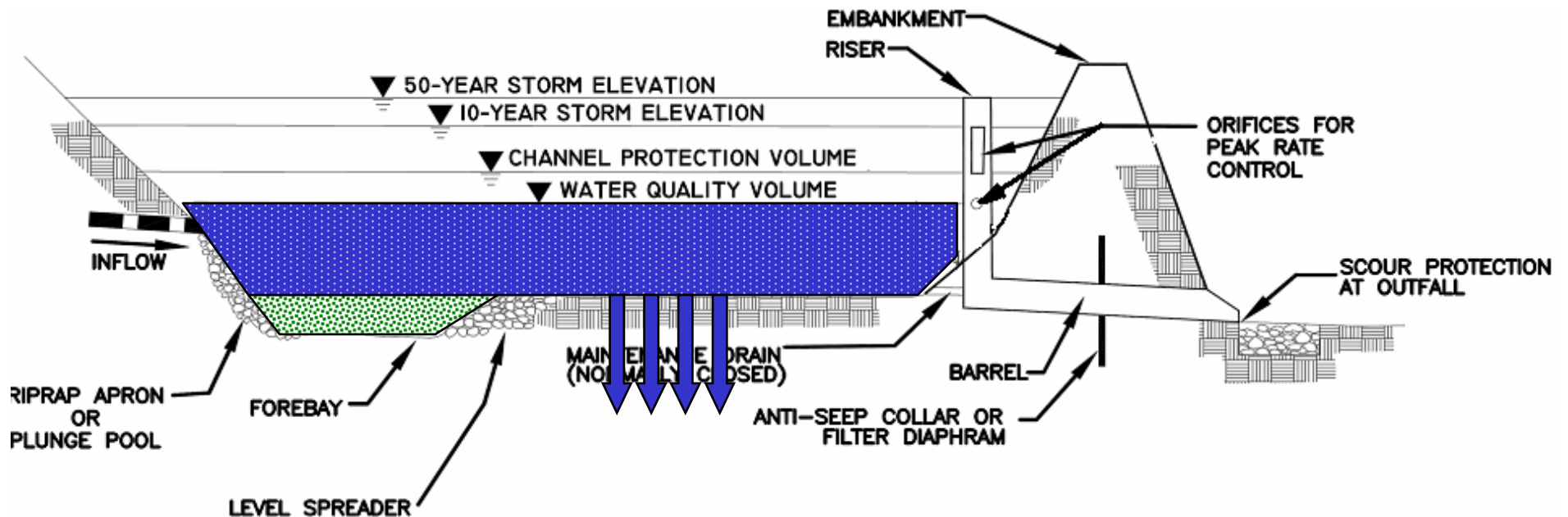Where Q_{avg} = $\dfrac{\text{Extend detention Volume}}{24 \text{ hrs}}$

Infiltration practices

Example: Infiltration pond

Criteria:
Store the WQV below the overflow without depending on infiltration
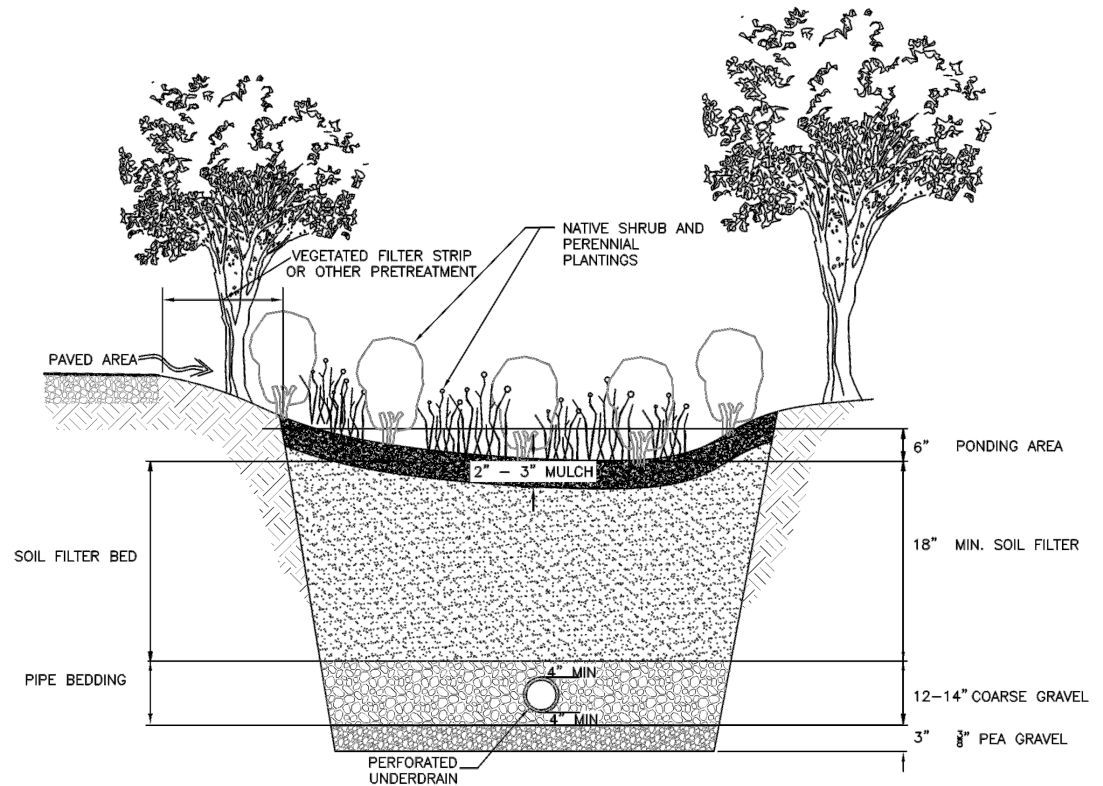Separation requirements: 3' of separation; 4' if within a GPA or WSIPA

Forebay

WQV

Filtering Practices

Examples:

1. Surface sand filters

2. Pervious pavement

3. Bioretention areas

4. Tree box filters

Bioretention criteria:

Store the WQV below the overflow without depending on infiltration.

Storage includes storage above the filter& the filter media voids.

Separation requirements: 1' below the bottom of the filter course.

If in a GPA or WSIPA, 1' below bottom of practice or 2x filter depth and 1' below bottom of filter course.

Infiltration rate selection

- Initial screening & Field verification

- Evaluation of selected infiltration areas ★
    - Default

    - Field rates

    - Lab rates

Default Values

- Determine which soil series are at the location of the practice.

- Determine the limiting layer (slowest Ksat) reported beneath the proposed bottom of the practice using the Physical Soil Properties reported by the USDA NRCS.

- The reported Ksat for a given layer typically has a range of values. Select the slowest value for the default rate.

- Use a weighted average by area if more than one soil series is present. Apply a minimum factor of safety of 2.

Default values may be used for native materials only.

Default values maybe easier to obtain, however the designer should note that this method is conservative!

Field Tests

Double-Ring Infiltrometer

•Design infiltration rates (Ksat tests)
  •Guelph Permeameter
  •Compact Constant Head Permeameter
    e.g., Amoozemeter
  •Double-Ring Infiltrometer
  •Borehole Infiltration test

•Qualified professional
  soil scientist, professional geologist, or an engineer

•Test at the proposed bottom elevation and within the footprint of the infiltration facility

•More tests needed as basin gets bigger

•Apply factor of safety of 2 to the field measured infiltration rate.

Lab Tests

- For proposed fill only

- ASTM D-2434 - Standard Test Method for Permeability of Granular Soils (Constant Head); or

- ASTM D-5856 - Standard Test Methods for Measurement of Hydraulic Conductivity of Porous Material Using a Rigid-Wall, Compaction-Mold Permeameter.

! Extreme caution! Many states prohibit infiltration into fill.

Limitations

- Soils too slow – underdrain may be necessary

- Soils too rapid for treatment – treat prior to recharging or amend soil:

   Default method: *Abenaki, Adams, Agawam, Boscawen, Caesar, Champlain, Colton, Croghan, Deerfield, Haven, Hermon, Hinckley, Hoosic, Metallak, Matunuck, Pawcatuck, Quonset, Raypol, and Warwick.*

   *** some of these soils <u>may</u> be slow enough, but must field test to confirm

   Testing: *> 10 inches per hour*

Floodplain Discussion

- Development within 100-yr floodplains will require compensatory storage and/or hydraulic analysis

- Additional requirements may evolve from the results of the Comprehensive Flood Management Study Commission

Comprehensive Flood Management Study Commission

- Laws of 2007, HB 648

- Final Report September 2008

http://gencourt.state.nh.us/statstudcomm/reports/1853.pdf

Commission Exec. Summary

- Flood damage can be mitigated through land use & development regulations.

  - Regulations must be implemented to protect undeveloped floodplains

- Need accurate floodplain mapping
  - Acknowledges outdated data and models
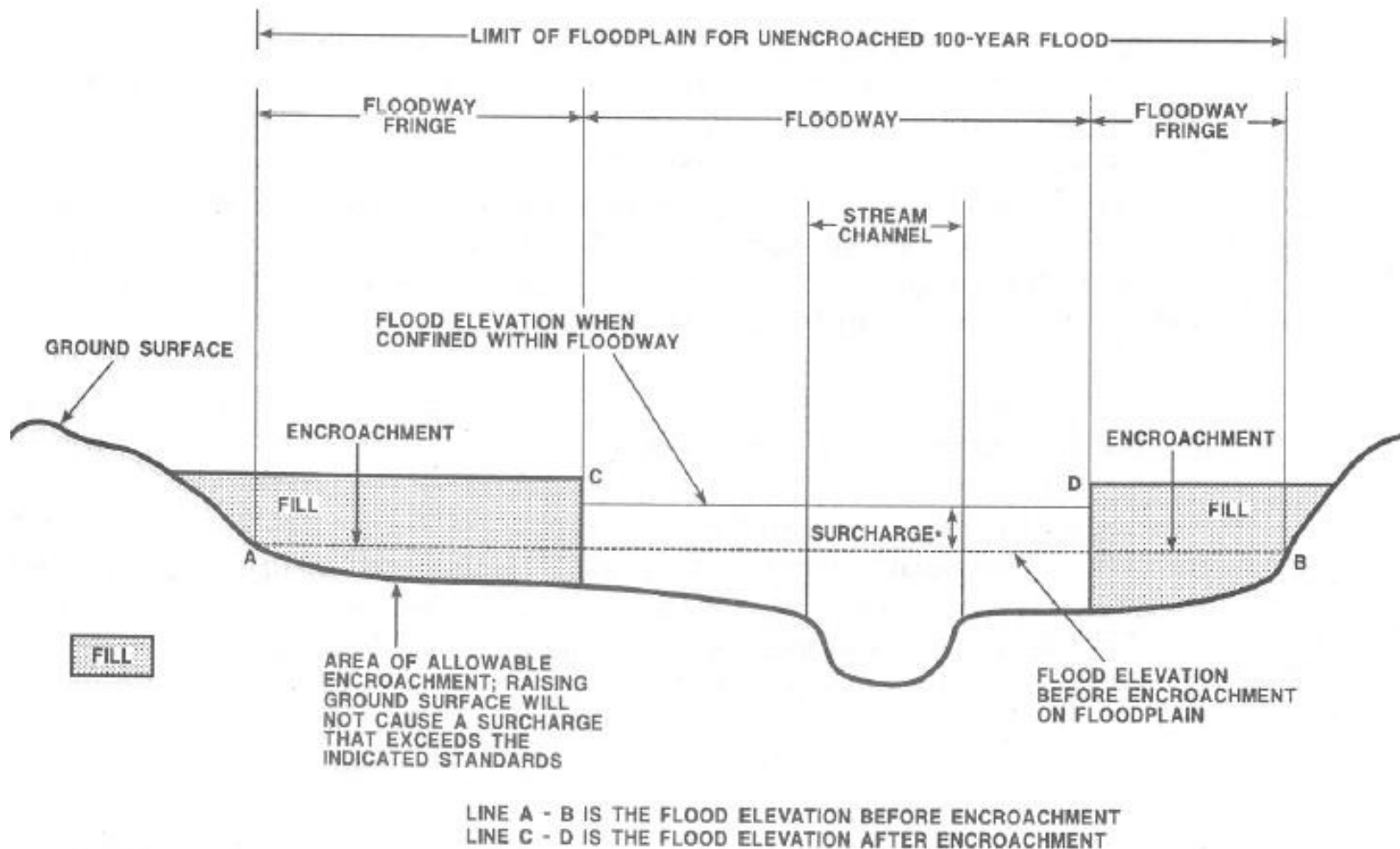
Commission Recommendations

- Prohibit new state facilities in flood hazard zones

- Incorporate floodplain management into AoT & Wetland regulations

  - Passage of 100-yr flood

  - No increase in flood stages to abutting properties to max. extent possible

- Municipalities to develop ordinances to prohibit construction (fill) within 100-yr floodplain

CFR 44 – Emergency Management & Assistance

- When flood elevations established but not floodway:

  No new construction or fill within zones A1-30 or AE unless demonstrated no increase > 1' in flood elev due to new development, existing and anticipated

Floodplain Encroachment

LIMIT OF FLOODPLAIN FOR UNENCROACHED 100-YEAR FLOOD

FLOODWAY FRINGE — FLOODWAY — FLOODWAY FRINGE

STREAM CHANNEL

FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY

GROUND SURFACE

ENCROACHMENT

FILL

C

SURCHARGE*

D

ENCROACHMENT

FILL

A

B

FILL

AREA OF ALLOWABLE ENCROACHMENT; RAISING GROUND SURFACE WILL NOT CAUSE A SURCHARGE THAT EXCEEDS THE INDICATED STANDARDS

FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOODPLAIN

LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT

* SURCHARGE NOT TO EXCEED 1.0 FOOT (FEDERAL EMERGENCY MANAGEMENT AGENCY REQUIREMENT) OR LESSER HEIGHT IF SPECIFIED BY STATE.

Email discussions?

- Overview of application requirements
- General permit by rule
- Buffers
- Pervious Pavement design and modeling
- Areas that need further protection ⭐
- Others? (put on comment sheet)

Q & A